

**WHAT IS CLAIMED IS:**

1. A material having a catalytic surface that has immobilized, or available at the surface thereof, a catalytic agent having nitrite reductase and/or nitrite reductase-like activity, or nitrosothiol reductase activity, which converts nitrite/nitrate or nitrosothiols to nitric oxide when the catalytic surface is in contact with blood.

2. The material of claim 1 wherein the catalytic agent is a biocatalytic agent.

3. The material of claim 2 wherein the biocatalytic agent is an enzyme having nitrite reductase and/or nitrite reductase-like activity, or a nitrosothiol reductase activity.

4. The material of claim 2 wherein the enzyme is selected from the group of nitrite reductases, nitrate reductases, enzymes having nitrosothiol reducing activity, and xanthine oxidase, or combinations thereof.

5. The material of claim 3 wherein the enzyme is xanthine oxidase.

6. The material of claim 1 wherein the catalytic agent is a biomimetic catalytic agent.

7. The material of claim 6 wherein the biomimetic catalytic agent is a metal ion ligand complex wherein the metal ion is capable of reducing one or more of nitrite, nitrate, nitrosothiols, and other nitrogen-containing blood species to nitric oxide.

8. The material of claim 7 wherein the biomimetic catalytic agent is a Cu(II) metal ion ligand complex.

9. The material of claim 8 wherein the Cu(II) metal ion ligand is selected from the group consisting of dibenzo[e,k]-2,3,8,9-tetraphenyl-1,4,7,10-tetraaza-cyclododeca-1,3,7,9-tetraene; dibenzo[e,k]-2,3,8,9-tetramethyl-1,4,7,10-tetraaza-cyclododeca-1,3,7,9-tetraene; and dibenzo[e,k]-2,3,8,9-tetraethyl-1,4,7,10-tetraaza-cyclododeca-1,3,7,9-tetraene.

10. The material of claim 1 wherein the material is selected from the group consisting of polymers, metals or carbon (graphite).

11. The material of claim 10 wherein the material is a polymer.

12. The material of claim 11 wherein the polymer is selected from the group of poly(vinyl chloride), polyurethane, and silicone rubber.

13. The material of claim 11 wherein the polymer further includes lipophilic salts of nitrite/nitrate or nitrosothiols within the polymer matrix to create a reservoir  
5 of nitrite/nitrate or nitrosothiol that can continuously leak to the catalytic surface.

14. The material of claim 13 wherein the lipophilic salt of nitrite/nitrate is tridodecylmethylammonium nitrite ( $\text{TDMA}^+ \text{NO}_2^-/\text{NO}_3^-$ ).

15. The material of claim 10 wherein the material is a metal.

16. The material of claim 15 wherein the metal is selected from the group  
10 consisting of stainless steel, nickel, titanium, aluminum, copper, gold, silver, platinum and alloys or combinations thereof.

17. The material of claim 15 wherein the catalytic agent is covalently attached to the surface of the metal.

18. The material of claim 15 wherein the surface of the metal is coated with  
15 a polymeric film having the catalytic agent incorporated into the matrix or attached to the surface of the polymeric film.

19. The material of claim 18 wherein the polymeric film further includes lipophilic salts of nitrite/nitrate or nitrosothiols within the polymer matrix to create a reservoir of nitrite/nitrate or nitrosothiol that can continuously leak to the catalytic  
20 surface.

20. A material comprising:

a hydrophobic polymer substrate; and

a catalytic agent having nitrite reductase and/or nitrite reductase-like activity, or a nitrosothiol reductase activity attached to a surface of the hydrophobic polymer  
25 substrate to form a catalytic surface.

21. The material of claim 20 further including, within the polymer substrate, lipophilic salts of nitrite/nitrate or nitrosothiols within the polymer matrix to create a reservoir of nitrite/nitrate or nitrosothiol that can continuously leak to the catalytic surface.

23. The material comprising:

a metal substrate; and

a biomimetic catalytic agent covalently attached to the surface.

24. The material of claim 23 wherein the biomimetic catalytic agent is a metal  
5 ion ligand complex wherein the metal ion is capable of reducing one or more of  
nitrite, nitrate, nitrosothiols, and other blood species to nitric oxide.

25. The material of claim 24 wherein the biomimetic catalytic agent is a Cu(II)  
metal ion ligand.

26. The material of claim 23 further comprising a polymeric film lipophilic  
10 salts of nitrite/nitrate or nitrosothiols within the polymer matrix to create a reservoir  
of nitrite/nitrate or nitrosothiol that can continuously leak to the catalytic surface.

27. A method of generating NO *in vivo* at the interface of a material surface  
and blood in response to contact of the surface with blood comprising:

15 providing catalytic agents at the surface of a material, the catalytic agents  
having nitrite reductase and/or nitrite reductase-like activity, or a nitrosothiol reductase  
activity; and

contacting the surface of the material to blood so as to convert nitrite/nitrate  
or nitrosothiols in the blood to nitric oxide.

28. The method of claim 27 further comprising the step of:

20 providing a polymeric film on the material that contains a source of lipophilic  
salts of nitrite/nitrate or nitrosothiols within the polymer matrix to create a reservoir  
of nitrite/nitrate or nitrosothiol that can continuously leak to the catalytic surface.

29. The method of claim 27 wherein the step of providing a catalytic agent  
comprises covalently binding or otherwise attaching or making available to the  
25 surface, Cu(II) ligand complexes for reducing nitrite/nitrate/nitrosothiols in the blood  
to NO.

30. The method of claim 27 wherein the step of providing a catalytic agent  
comprises covalently binding or otherwise attaching or making available to the  
surface, an enzyme having nitrite reductase and/or nitrite reductase-like activity, or

a nitrosothiol reductase activity, for reducing nitrite/nitrate/nitrosothiols in the blood to NO.

31. A device comprising:

5 a material having immobilized, or available at a surface thereof, a catalytic agent having nitrite reductase and/or nitrite reductase-like activity, or a nitrosothiol reductase activity, which converts nitrite/nitrate or nitrosothiols to nitric oxide when in contact with blood.

10 32. The device of claim 32 wherein the the medical device is selected from the group consisting of arterial stents, guide wires, catheters, bone anchors and screws, protective platings, hip and joint implants, spine appliances, electrical leads, biosensors and probes.

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